

GULFSTREAM IV

STRUCTURAL REPAIR MANUAL

FASTENER TYPES, MATERIALS AND SIZES — STRUCTURAL IDENTIFICATION

1. Clamps

A. Standard Clamp Usage (Optional)

To provide proper clamping action, one size smaller or larger clamps called out on drawings may be utilized. See Table 1.

NOTE: Size variation larger / smaller than one size is permitted. Substitute clamp shall be of proper size to prevent movement of wiring inside clamp. Combining of adjacent wire runs into one wire run is not permitted. Refer to Aircraft Maintenance Manual for clamp application and location.

B. Installation of Polyamide (Glass Filled Nylon) and Micarta Tube Support Clamps (Optional)

See Figure 1.

Blocks may be reamed to compensate for paint thickness.

Tube identification tape and tube bend shall not fall within block.

Gaps are permissible provided tube is supported by axial contact in both halves of block and tube is well restrained when screws are tightened.

C. Installation of GAC837BD Bulkhead Clamp (Optional)

See Figure 2.

The antirotation lug is to be removed prior to installation. Do not make a provision for antirotation lug in structure. Refer to Aircraft Maintenance Manual for clamp application and location.

D. GAS502A Clamp Safety Wiring of (Optional)

On installations using GAC502A clamps which when rotated will come into contact with any part or installation in the aircraft it is permissible to install an AN735 clamp adjacent to GAC502A and to safety wire GAC502A to AN735 using MS20995NC32 safety wire.

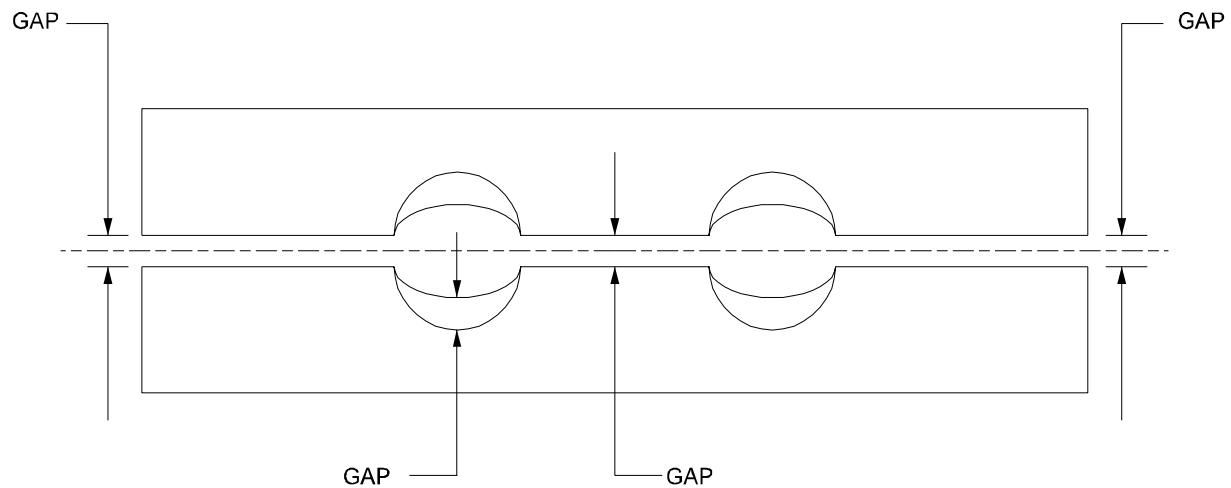
Table 1: Clamps

AN735	GAC500C
AN742	GAC500G
GAC2A	GAC500H
GAC12G	NAS1715
GAC500A	MS25281
GAC500B	MS21919

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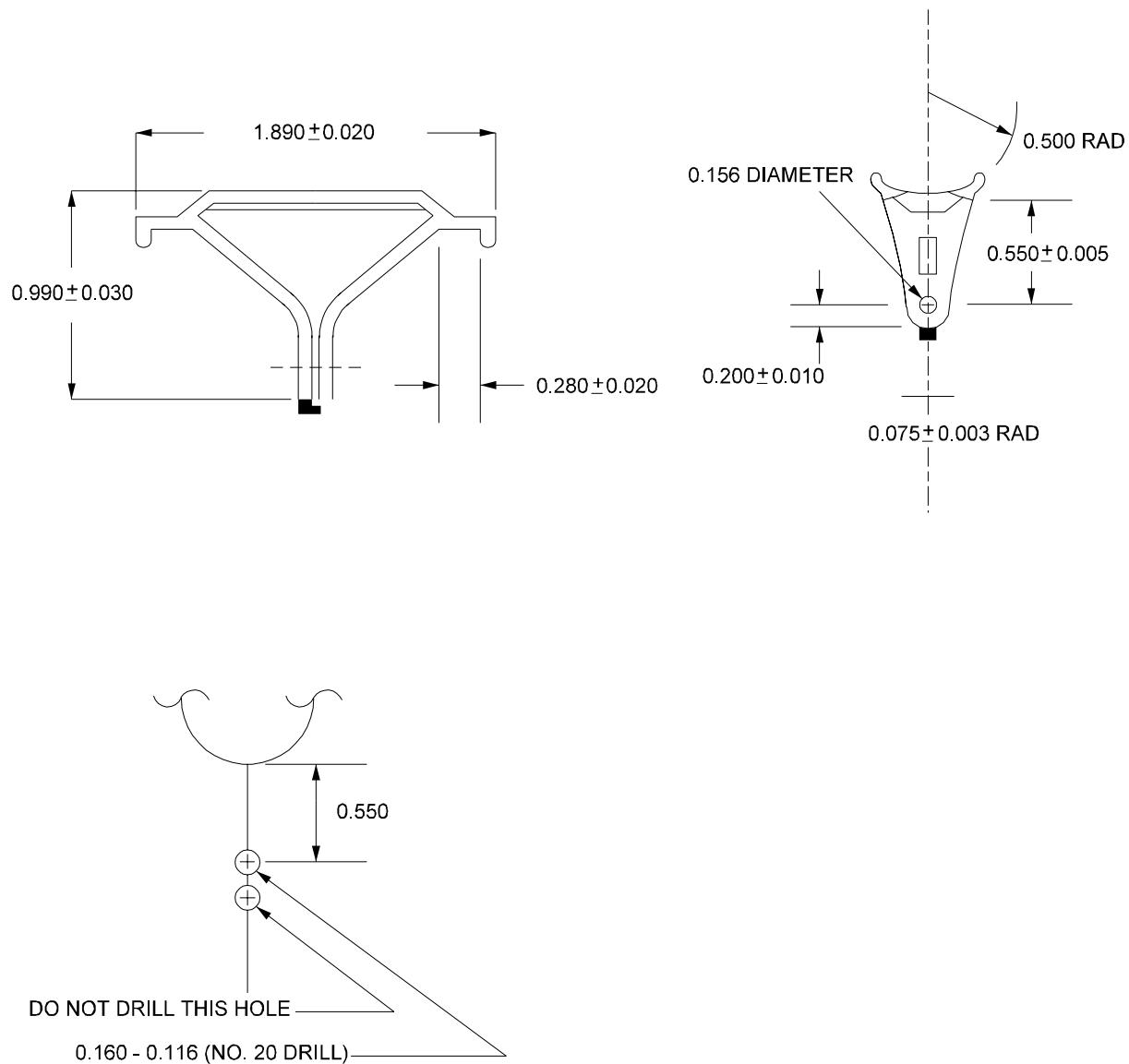
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Clamp Gaps
Figure 1

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Clamp Installation
 Figure 2

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2. Fasteners Bolts / Screws

A. Bolts / Screws

(1) Fastener Hole Diameters and Hole Preparations (Edge Breaks, Surface Finish, Etc.) (Optional)

The following hole diameters and hole preparations (edge break, surface finish, etc.) may be produced instead of those specified / invoked on engineering documents:

Removable type fasteners (bolts and screws) having hole diameter callouts coinciding with the bolt / screw hole diameters in Hole Preparation Specification - Metallic and Composite Structure Fasteners, 51-42-00, Repair.

Removable type fasteners (bolts and screws) having hole diameters specified in Column A in Table 2 below may have the hole diameters / hole preparations produced in accordance with Column B.

Permanent type fasteners (rivets, blind bolts, Hi-Loks, Hi-Tigues, cherrybucks, etc.) may have hole diameters and hole preparation as indicated in Table 3 and Table 4 and Figure 3.

(2) Hole Diameters / Hole Preparation

Hole diameters / hole preparation for removable as well as permanent type fasteners (except solid rivets) produced per Hole Preparation Specification - Metallic and Composite Structure Fasteners, 51-42-00, Repair as permitted by this practice are subject to the following qualifications:

When top sheet thickness for protruding head fastener is less than 0.050, no hole edge break is permissible. In such cases, flat washers per AN960 (steel, Cadmium plated, CRES or aluminum alloy) or MS15795 (CRES or aluminum alloy) apply under the bolt head as follows:

When structure is steel, washer made of steel, cadmium plated or CRES washer shall be used.

When structure is titanium or composite, CRES washer shall be used.

When structure is aluminum alloy, use of washer is optional. When a washer is used, the washer material may be aluminum alloy or cadmium plated steel.

High strength 12 point bolts (MS21250, GAB511B, C, W, BE, etc.) and internal wrenching bolts (MS20004 thru 20024) shall have flat countersunk washers (MS21299C) under bolt head instead of edge break. When MS21299C washers are out of stock, MS2000C washer may be used instead and vice versa.

(3) Fastener Length Variations - Allowance For (Optional)

The following are fastener length variation allowances:

When proper length of the fastener is not available.

Where required by tolerance accumulations.

Where shimming is permitted which caused variations in pack up at fastener locations.

It is permissible to use up to a maximum of two grip lengths longer fastener provided thread engagement and clearance requirements are maintained.

It is also permissible to use a one grip length shorter fastener (except for cherrybucks) provided material thickness at the fastener adjacent to the nut is greater than 0.093 and thread engagement and clearance required are maintained.

For bolts and screws, washers may be used in addition to the drawing callout up to a total maximum of three (one under head and maximum of two under nut or collar), for cherrybucks,

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washers may be used up to a total maximum of two (two under the head only). This does not include NAS1598 (or equivalent) sealing washers.

Sealing washers must always bear on the sheet surface.

Thick or thin washers may be interchanged to effect an acceptable installation. See Table 5.

(4) Torque Values

Torque values quoted in Table 6, Table 7 and Table 8 are standard values for threaded fasteners and may differ from those quoted in the Aircraft Maintenance Manual for specific applications. In cases where a special torque value is given in the Aircraft Maintenance Manual, the Maintenance Manual shall take precedence.

Table 2: Hole Preparation / Hole Diameter

COLUMN A	COLUMN B
BOLT / SCREW HOLE DIAMETER SPECIFIED ON ENGINEERING DRAWING	PERMISSIBLE SUBSTITUTE HOLE DIAMETER / HOLE PREPARATION⁽¹⁾
0.1690 - 0.1740	51-30-22-171GN
0.1960 - 0.2010	51-30-22-197GN
0.3230 - 0.3280	51-30-22-320GN
0.3860 - 0.3910	51-30-22-382GN
0.4531 - 0.4581	51-30-22-445GN

⁽¹⁾ See Hole Preparation Specification - Metallic and Composite Structure Fasteners, 51-42-00, Repair for definition of hole preparation.

NOTE: All fastener sizes are in inches.

Table 3: Fastener Hole Preparation Code

FASTENER	1/16	3/32	1/8	5/32	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4
GAB510A				164CE	190CE	250CE	3125CE	375CE	4375CE	500CE		
GAB510B				164CE	190CE	250CE	3125CE	375CE	4375CE	500CE		
GAB510C					190CE	250CE	3125CE	375CE	4375CE	500CE		
GAB510D				164CE	190CE	250CE	3125CE	375CE	4375CE	500CE	625CE	750CE
GAB510E				164CE	190CE	250CE	3125CE	375CE	4375CE	500CE		
GAB510H					190CE	250CE	3125CE	375CE				
GAB510J					190CE	250CE	3125CE	375CE				
GAB510U				164CE	190CE	250CE	3125CE	375CE	4375CE	500CE		
GAB510V					190CE	250CE	3125CE	375CE	4375CE	500CE		
GAB510AS					190CE	250CE						
GAB510BH					190CE	250CE	3125CE	375CE	4375CE	500CE	625CE	750CE
GAB510BM					190CE	250CE	3125CE	375CE	4375CE			
GAB511D				164CE	190CE	250CE	3125CE	375CE	4375CE	500CE	625CE	750CE

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GAB511E				190CE	250CE	3125CE	375CE	4375CE	500CE		
GAB511F				164CE	190CE	250CE					
GAB511G				164CE	190CE	250CE	3125CE	375CE	4375CE	500CE	
GAB511K				164CE	190CE	250CE	3125CE	375CE	4375CE	500CE	625CE
GAB511AR				164CE	190CE	250CE	3125CE	375CE	4375CE	500CE	
GAB511AW					190CE	250CE	3125CE				
GAB511BC					190AE	250AE	3125AE	375AE	4375AE	500AE	625CA
GAB511BJ				164CE	190AE	250AE	3125AE	375AE	4375AE	500AE	
GAB511BN					190AE	250AE	3125A	375AE	4375AE	500AE	625CA
GAB511BV					190AE	250AE	3125A	375AE	4375AE	500AE	625CA
GAB511CF					190AE	250CE	3125CE				
GAB511CK						250AE	3125AE	375CE			
GAB511CW					190CE	250AE	3125AE	375CE	4375CE	500CE	625CA
GAB511DC					190CE	250AE	3125AE	375CE	4375CE	500CE	
GAF511K					190CE	250AE	3125AE				
GAP510C					190CE	250AE	3125AE	375CE			
GAP510D					190CE	250AE	3125AE	375CE			
GAR10J			1285GN	161GN	1935GN	257GN					
GAR10K				161GN	1935GN						
GAR10L				151GN			316GN				
GAR500D	070GN	098GN	1285GN	161GN	1935GN	257GN	316GN				
GAR500AC		098GN									
GAR500AE			129CE	160EE	192EE						
GAR500W			1285GN	161GN	1935GN	257GN	316GN				
GAR501AC		098GN									
GAR501B		098GN	1285GN	161GN	1935GN	257GN	316GN				
GAR501F		098GN									
GAR501K	070GN	098GN	1285GN	161GN	1935GN	257GN	316GN				
GAR501V		098GN	1285GN	161GN	1935GN	257GN					
GAR501W			1285GN	161GN	1935GN	257GN	316GN				
GAR501Y		098GN	1285GN	161GN	1935GN	257GN					
GA380						257GN	316GN				
MS20426	070GN	098GN	1285GN	161GN	1935GN						
MS20427	070GN	098GN	1285GN	161GN	1935GN						
MS20470	070GN	098GN	1285GN	161GN	1935GN						
MS20600			129CE	160EE	192EE						

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MS20601			129CE	160EE	192EE							
MS20604		098GN	129CE	160EE	192EE							
MS20605		098GN	129CE	160EE	192EE							
MS20613	070GN	098GN	1285GN	161GN	1935GN	257GN	316GN					
MS20615	070GN	098GN	1285GN	161GN	1935GN	257GN	316GN					
MS90353				164CE	199CE	260CE	3125AE	375CE	4375CE	500CE		
NAS1054					190CE	250CE	3125CE	375CE				
NAS1055					190CE	250CE	3125CE	375CE				
NAS1097		098GN	1285GN	161GN	1935GN	257GN						
NAS1198	070GN	098GN	1285GN	161GN	1935GN	257GN						
NAS1199	070GN	098GN	1285GN	161GN		257GN						
NAS1200		098GN	1285GN	161GN	1935GN	257GN						
NAS1415				164CE	190CE	250CE	3125CE	375CE				
NAS1416				164CE	190CE	250CE	3125CE	375CE				
NAS1417				164CE	190CE	250CE	3125CE	375CE				
NAS1418				164CE	190CE	250CE	3125CE	375CE				
NAS1419				164CE	190CE	250CE	3125CE	375CE				
NAS1420				164CE	190CE	250CE	3125CE	375CE				
NAS1421				164CE	190CE	250CE	3125CE	375CE				
NAS1422				164CE	190CE	250CE	3125CE	375CE				
NAS1425				164CE	190CE	250CE	3125CE	375CE				
NAS1426				164CE	190CE	250CE	3125CE	375CE				
NAS1427				164CE	190CE	250CE	3125CE	375CE				
NAS1428				164CE	190CE	250CE	3125CE	375CE				
NAS1429				164CE	190CE	250CE	3125CE	375CE				
NAS1430				164CE	190CE	250CE	3125CE	375CE				
NAS1431				164CE	190CE	250CE	3125CE	375CE				
NAS1432				164CE	190CE	250CE	3125CE	375CE				
NAS1436					190CE	250CE	3125CE	375CE				
NAS1437					190CE	250CE	3125CE	375CE				
NAS1438					190CE	250CE	3125CE	375CE				
NAS1439					190CE	250CE	3125CE	375CE				
NAS1440					190CE	250CE	3125CE	375CE				
NAS1441					190CE	250CE	3125CE	375CE				
NAS1442					190CE	250CE	3125CE	375CE				
NAS1446					190CE	250CE	3125CE	375CE				

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NAS1447					190CE	250CE	3125CE	375CE					
NAS1449					190CE	250CE	3125CE	375CE					
NAS1450					190CE	250CE	3125CE	375CE					
NAS1451					190CE	250CE	3125CE	375CE					
NAS1452					190CE	250CE	3125CE	375CE					
NAS1456					190CE	250CE	3125CE	375CE					
NAS1457					190CE	250CE	3125CE	375CE					
NAS1458					190CE	250CE	3125CE	375CE					
NAS1459					190CE	250CE	3125CE	375CE					
NAS1460					190CE	250CE	3125CE	375CE					
NAS1461					190CE	250CE	3125CE	375CE					
NAS1462					190CE	250CE	3125CE	375CE					
NAS1465					190CE	250CE	3125CE	375CE					
NAS1466					190CE	250CE	3125CE	375CE					
NAS1467					190CE	250CE	3125CE	375CE					
NAS1468					190CE	250CE	3125CE	375CE					
NAS1469					190CE	250CE	3125CE	375CE					
NAS1470					190CE	250CE	3125CE	375CE					
NAS1471					190CE	250CE	3125CE	375CE					
NAS1472					190CE	250CE	3125CE	375CE					
NAS1475					190CE	250CE	3125CE	375CE					
NAS1476					190CE	250CE	3125CE	375CE					
NAS1477					190CE	250CE	3125CE	375CE					
NAS1478					190CE	250CE	3125CE	375CE					
NAS1486					190CE	250CE	3125CE	375CE					
NAS1487					190CE	250CE	3125CE	375CE					
NAS1488					190CE	250CE	3125CE	375CE					
NAS1489					190CE	250CE	3125CE	375CE					
NAS1490					190CE	250CE	3125CE	375CE					
NAS1491					190CE	250CE	3125CE	375CE					
NAS1492					190CE	250CE	3125CE	375CE					
NAS1496					190CE	250CE	3125CE	375CE					
NAS1498					190CE	250CE	3125CE	375CE					
NAS1499					190CE	250CE	3125CE	375CE					
NAS1500					190CE	250CE	3125CE	375CE					
NAS1501					190CE	250CE	3125CE	375CE					

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NAS1502					190CE	250CE	3125CE	375CE				
NAS1525				164CE	190CE							
NAS1526				164CE	190CE							
NAS1669				165CE	199CE	260CE	3125CE	375CE				
NAS1670				165CE	199CE	260CE	3125CE	375CE				
NAS1671				165CE	199CE	260CE	3125CE	375CE				
NAS1672				165CE	199CE	260CE	3125CE	375CE				
NAS1673				165CE	199CE	260CE						
NAS1674				165CE	199CE	260CE						
NAS1919			129CE	160EE	192EE							
NAS1921			129CE	160EE	192EE							
NAS2106					190CE	250CE	3125CE					
NAS2107					190CE	250CE	3125CE					
NAS2108					190CE	250CE	3125CE					
NAS2109					190CE	250CE	3125CE					
NAS2110					190CE	250CE	3125CE					
NAS2406					190CE	250CE	3125CE	375CE				
NAS2407					190CE	250CE	3125CE	375CE				
NAS2408					190CE	250CE	3125CE	375CE				
NAS2409					190CE	250CE	3125CE	375CE				
NAS2410					190CE	250CE	3125CE	375CE				
NAS2411					190CE	250CE	3125CE	375CE				
NAS2412					190CE	250CE	3125CE	375CE				
NAS2706					190CE	250CE	3125CE	375CE				
NAS2707					190CE	250CE	3125CE	375CE				
NAS2708					190CE	250CE	3125CE	375CE				
NAS2709					190CE	250CE	3125CE	375CE				
NAS2711					190CE	250CE	3125CE	375CE				
NAS2712					190CE	250CE	3125CE	375CE				

Table 4: Fastener Hole Preparation Code - Sleeves

FASTENER	NO. 4	NO. 5	NO. 6	NO. 8	NO. 10	NO. 12	1/4	5/16	3/8	7/16	1/2
GAC530A ⁽¹⁾	170CE	197EE		258JE		339JE	391JE	469JE	531NE		
GAC530B ⁽¹⁾	170CE	197EE		258JE		339JE	391JE	469JE	531NE		

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GAC530E ⁽¹⁾		197EE	219CE	258JE							
GAC530D	170CE		219CE	258JE	313JE		391JE	469JE	531NE	595NE	636NE

⁽¹⁾ Hole preparations are for sleeves used with these core bolts.

Table 5: Washer Applications

FASTENERS	WASHER
Bolts (including Hi-Loks and Hi-Tigues) Cherrybucks Screws	AN960 aluminum - Except when drawing specifies a countersunk washer (use MS20002 steel)

NOTE: Exception - In the case of self retaining positive locking bolts, washers may be used under the heads only.

Table 6: Fine Threaded Steel Fasteners Torque Table - Bolts / Nuts

	Bolts - Tension		Bolts - Tension	
	AN4 thru AN20		MS20004 thru MS20024	
	AN42 thru AN49		NAS144 thru NAS158	
	AN73 thru AN81		NAS333 thru NAS340	
	AN173 thru AN186		NAS583 thru NAS590	
	MS20033 thru MS20046		NAS624 thru NAS644	
	MS20073		NAS1303 thru NAS1320	
	MS20074		NAS172	
	AN509 NK9		NAS174	
	MS24694		NAS517	
	AN525 NK 525			
	Nuts Steel Tension	Nuts Steel Shear	Nuts Steel Tension	Nuts Steel Shear
	AN310	AN320	AN310	AN320
	AN315	AN364	AN315	AN364
	AN363	NAS1022	AN363	NAS1022
	AN365	MS17826	AN365	MS17826
	NAS1021	MS20364	MS17825	MS20364
	MS17825		MS20365	STEEL SHEAR BOLT (SSB) NAS464
	MS21045		MS21045	SSB NAS 464
	MS20500		NAS1021	SSB NAS 464

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	NAS679		NAS1291	SSB NAS 464
FASTENER	Torque (Inch-pounds) Min / Max			
1/4" - 28	50 / 70	30 / 40	80 / 100	50 / 60
5/16" - 24	100 / 140	60 / 85	120 / 145	70 / 90
3/8" - 24	160 / 190	95 / 110	200 / 250	120 / 150
7/16" - 20	450 / 500	270 / 300	520 / 630	300 / 400
1/2" - 20	480 / 690	290 / 410	770 / 950	450 / 550
9/16" - 18	800 / 1000	480 / 600	1100 / 1300	650 / 800
5/8" - 18	1100 / 1300	660 / 780	1250 / 1550	750 / 950
3/4" - 16	2300 / 2500	1300 / 1500	2650 / 3200	1600 / 1900
7/8" - 14	2500 / 3000	1500 / 1800	3550 / 4350	2100 / 2600
1.0" - 14	3700 / 4500	2200 / 3300	4500 / 5500	2700 / 3300
1 1/8" - 12	5000 / 7000	3000 / 4200	6000 / 7300	3600 / 4400
1 1/4" - 12	9000 / 11000	5400 / 6600	11000 / 13400	6600 / 8000

Table 7: Fine Threaded Aluminum Fasteners Torque Table - Aluminum Bolts

FASTENER	Bolts Aluminum	
	AN4DD thru AN20DD, AN173DD thru AN186DD, AN509DD, AN525DD, MS27039D, MS24694DD	
	Torque (Inch-pounds) Min / Max	Torque (Inch-pounds) Min / Max
1/4 inch - 28	30 / 45	15 / 30
5/16 inch - 24	40 / 65	25 / 40
3/8 inch - 24	75 / 110	45 / 70
7/16 inch - 20	180 / 280	110 / 170
1/2 inch - 20	280 / 410	160 / 260
9/16 inch - 18	380 / 580	230 / 360
5/8 inch - 18	550 / 670	270 / 420
3/4 inch - 16	950 / 1250	560 / 880
7/8 inch - 14	1250 / 1900	750 / 1200
1.0 inch - 14	1600 / 2400	950 / 1500
1 1/8 inch - 12	2100 / 3200	1250 / 2000
1 1/4 inch - 12	3900 / 5600	2300 / 3650

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Table 8: Fine Threaded Aluminum Fasteners Torque Table - Aluminum Nuts

FASTENER	Nuts Aluminum Tension	Nuts Aluminum Shear
	AN365D, AN310D, NAS1021D	AN320D, AN364D, NAS1022D
	Torque (Inch-pounds) Min / Max	
1/4 inch - 28	30 / 45	15 / 30
5/16 inch - 24	40 / 65	25 / 40
3/8 inch - 24	75 / 110	45 / 70
7/16 inch - 20	180 / 280	110 / 170
1/2 inch - 20	280 / 410	160 / 260
9/16 inch - 18	380 / 580	230 / 360
5/8 inch - 18	550 / 670	270 / 420
3/4 inch - 16	950 / 1250	560 / 880
7/8 inch - 14	1250 / 1900	750 / 1200
1.0 inch - 14	1600 / 2400	950 / 1500
1 1/8 inch - 12	2100 / 3200	1250 / 2000
1 1/4 inch - 12	3900 / 5600	2300 / 3650

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FASTENER NUMBER	HOLE DIAMETER		Chamfer (Max) 90° X Dia	PROTRUDING HEAD		FLUSH HEAD	
	CLEARANCE FIT	INTERFERENCE FIT		Radius with 160° CSK	Radius with 100° CSK	Min / Max Radius	MAX CSK DIA
GAR501AB6	0.199 - 0.202						0.025 / 0.035
MS16535(0.061)	0.061 - 0.066						
MS16535(0.089)	0.088 - 0.093						
MS16535(0.123)	0.125 - 0.129						
MS16535(0.146)	0.146 - 0.152						
MS16535(0.188)	0.188 - 0.194						
NAS1054-4	0.125 - 0.128		0.151	0.015 / 0.025	0.175	0.005 / 0.020	0.155
NAS1054-5	0.157 - 0.160		0.193	0.020 / 0.030	0.217	0.005 / 0.020	0.197
NAS1055-4	0.125 - 0.128						0.005 / 0.020
NAS1055-5	0.157 - 0.160						0.005 / 0.020
CSR945F-6	51-30-22	0.1845 - 0.1875	0.226	0.020 / 0.030	0.250	0.020 / 0.035	0.230
CSR945F-8	51-30-22	0.2445 - 0.2475	0.285	0.020 / 0.030	0.310	0.020 / 0.035	0.290
HLT50-6		0.1845 - 0.1875	0.226	0.020 / 0.030	0.250	0.020 / 0.035	0.230
HLT410-6		0.1845 - 0.1875	0.226	0.020 / 0.030	0.250	0.020 / 0.035	0.230
HLT412-6		0.1845 - 0.1875	0.226	0.020 / 0.030	0.250	0.020 / 0.035	0.230
HLT412-8		0.2445 - 0.2475	0.286	0.020 / 0.030	0.310	0.020 / 0.035	0.290

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Edge Break Dimensions
 Figure 3

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3. Fasteners — Hi-Lok / Hi-Tigue

A. Hi-Lok / Hi-Tigue

- (1) Head Gaps Permanently Installed Fasteners (Hi-Loks, Blind Bolts, Blind Rivets, Solid Rivets, Etc.) (Mandatory)

The only criteria for gaps under the heads of the above protruding and flush head fasteners shall be as follows:

If one side of the head is visibly in contact with the part surface and a 0.004 inch feeler gage will not enter the gap side, the fastener head gap is acceptable providing there is at least 50% bearing.

- (2) Oversize Hi-Lok / Hi-Tigue Fasteners For Use in Repair Replacement of Cherrybuck and Hi-Tigue Fasteners (Optional)

Table 9 is a listing of oversize Hi-Tigue fasteners / collars for repair use in replacement of the noted interference fit cherrybuck and Hi-Tigue fasteners.

Table 10 is a listing of oversize Hi-Lok fasteners / collars for repair use in replacement of the noted clearance fit cherrybuck fastener.

Table 11 is a listing of the associated holes and hole edge breaks to be used with the oversize hardware in Table 9 and Table 10.

- (3) Oversize Hi-Lite Fasteners For Use in Repair Replacement of Hi-Lite Fasteners

Table 12 is a listing of oversize Hi-Lite fasteners / collars for repair use in replacement of standard Hi-Lite fasteners.

Table 13 is a listing of oversize Hi-Lite / Hi-Tigue fastener collars for repair use in replacement of standard Hi-Lite / Hi-Tigue fasteners.

Table 14 gives the hole size requirements for oversize Hi-Lite and Hi-Lite / Hi-Tigue fasteners.

Table 9: Interference Fit Fasteners

ORIGINAL FASTENER	COLLAR	1/64 INCH OVERRSIZE		1/32 INCH OVERRSIZE	
		Fastener	Collar	Fastener	Collar
CSR945F ⁽¹⁾ HLT410 ⁽¹⁾	None (Formed Tail) HLT77 ⁽²⁾	HLT110 ⁽¹⁾	HLT277 ⁽²⁾	HLT210 ⁽¹⁾	HLT278 ⁽²⁾
	HLT78 ⁽²⁾	HLT112 ⁽¹⁾	HL278 ⁽²⁾	HLT212 ⁽¹⁾	HL278 ⁽²⁾
HLT412 ⁽¹⁾	HLT78 ⁽²⁾	HLT112 ⁽¹⁾	HL278 ⁽²⁾	HLT212 ⁽¹⁾	HL278 ⁽²⁾
HLT50 ⁽¹⁾	HLT70 ⁽²⁾	HLT150 ⁽¹⁾	HL79 ⁽²⁾	HLT250 ⁽¹⁾	HL84 ⁽²⁾

⁽¹⁾ Indicates the repair fasteners must have the same nominal diameter and grip dash number as the original fastener.

⁽²⁾ Indicates the mating collar must have the same nominal diameter dash number as the repair fastener (on Hi-Shear drawings the nominal diameter is listed as the nominal diameter plus the amount of oversize while the dash number remains the same as the original fastener).

NOTE: If washers are required, it is permissible to open up AN960D washer ID a maximum of 0.032 inch and countersink ID to provide head to shank fillet radius clearance.

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Table 10: Oversize Hi-Loks Repair Replacement for Clearance Fit Cherrybuck Fasteners

ORIGINAL FASTENER		1/64 INCH OVERRSIZE		1/32 INCH OVERRSIZE	
		Fastener	Collar	Fastener	Collar
CSR945F ⁽¹⁾	Formed Tail	HL62 ⁽¹⁾	HL79 ⁽²⁾	HL218 ⁽¹⁾	HL84 ⁽²⁾

⁽¹⁾ Indicates the repair fasteners must have the same nominal diameter and grip dash number as the original fastener.

⁽²⁾ Indicates the mating collar must have the same nominal diameter dash number as the repair fastener (on Hi-Shear drawings the nominal diameter is listed as the nominal diameter plus the amount of oversize while the dash number remains the same as the original fastener).

NOTE: If washers are required, it is permissible to open up AN960D washer ID a maximum of 0.032 inch and countersink ID to provide head to shank fillet radius clearance.

Table 11: Edge Break Dimensions

PROTRUDING HEAD FASTENER NUMBER	HOLE DIAMETER		MAX CHAMFER 90° X DIA.
	Clearance Fit	Interference Fit	
HLT110-6		0.1976 - 0.2006	0.234
HLT150-6		0.1976 - 0.2006	0.234
HLT150-6		0.1976 - 0.2006	0.234
HLT110-8		0.2601 - 0.2631	0.296
HLT112-8		0.2601 - 0.2631	0.296
HLT150-8		0.2601 - 0.2631	0.296
HLT210-6		0.2132 - 0.2162	0.249
HLT212-6		0.2132 - 0.2162	0.249
HLT250-6		0.2132 - 0.2162	0.249
HLT210-8		0.2757 - 0.2787	0.312
HLT212-8		0.2757 - 0.2787	0.312
HLT250-8		0.2757 - 0.2787	0.312
GAB511AM6	0.2031 - 0.2061		0.239
GAB511AM8	0.2656 - 0.2686		0.102
GAN511CS3	0.2787 - 0.2817		0.254
GAB511CS4	0.2812 - 0.2842		0.217

NOTE: See Hole Preparation Specification - Metallic and Composite Structure Fasteners, 51-42-00, Repair for configuration.

Hole edge break shall be required unless the hole is used in sheet thickness less than 0.060 or if washer is used under fastener head.

If fastener head gap requirements are met the hole edge break may be less than specified.

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Table 12: Oversize Hi-Lite Fasteners

ORIGINAL FASTENER - COLLAR	1/64 INCH OVERSIZE		1/32 INCH OVERSIZE	
	Fastener	Collar	Fastener	Collar
HST19 - HST70	HSTB235	HST84	HSTB335	HST84
HST20 - HST1078	HST248	HST1078	HST748	HST197
HST21 - HST1078	HST249	HST1078	HST749	HST197
HST49 - HST1078	HST249	HST1078	HST749	HST197
HST644 - HST70	HSTB754	HST84	HSTB854	HST84
HST645 - HST70	HSTB755	HST84	HSTB855	HST84

Table 13: Oversize Hi-Lite / Hi-Tigue Fasteners

ORIGINAL FASTENER - COLLAR	1/64 INCH OVERSIZE		1/32 INCH OVERSIZE	
	Fastener	Collar	Fastener	Collar
HSTB116 - HST1078	HSTB216	HST1078	HSTB316	HST197
HSTB134 - HST70	HSTB234	HST84	HSTB334	HST84
HSTB135 - HST70	HSTB235	HST84	HSTB335	HST84
HSTB409 - HST70	HSTB611	HST84	HSTB711	HST84
HSTB644 - HST70	HSTB110	HST84	HSTB210	HST84
HSTB645 - HST70	HSTB754	HST84	HSTB854	HST84
HSTB135 - HST82	HSTB235	HST182	HSTB335	HST182
HSTB409 - HST82	HSTB235	HST182	HSTB335	HST182

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Table 14: Hole Sizes for Oversize Hi-Lite / Hi-Tigue Fasteners

NOMINAL FASTENER DIA.	OVERSIZE	HOLE DIAMETER	
		Interference Fit	Clearance Fit
3/16 inch	1/64 inch	0.1980 - 0.2010	0.2030 - 0.2060
	1/32 inch	0.2135 - 0.2165	0.2185 - 0.2215
1/4 inch	1/64 inch	0.2605 - 0.2635	0.2655 - 0.2685
	1/32 inch	0.2760 - 0.2790	0.2810 - 0.2840
5/16 inch	1/64 inch	0.3230 - 0.3260	0.3280 - 0.3310
	1/32 inch	0.3385 - 0.3415	0.3435 - 0.3465

4. Fasteners — Rivets

A. Rivets

- (1) Rivet Substitution (Optional)

See Table 15.

- (2) Solid Rivets - Flush On The Bucked (Formed Head) Side (Optional)

When engineering drawings specify solid rivets to be installed flush on the bucked side, the countersink angle shall be 78° and the countersink diameter of the bucked head shall be in accordance with the following:

NOTE: The installed rivet shall meet aerodynamic smoothness requirements per aerodynamic smoothness specification. See Aerodynamic Contour Smoothness, 51-14-00, Repair, if applicable.

- Standard head aluminum rivet (MS20426 and MS20470). See Table 16
- Reduced head aluminum (NAS1097) and standard head Monel rivets (MS20427 and MS20615). See table 17

- (3) Solid or Blind Rivet Grip Lengths (Optional)

Rivet grip lengths shall be based on actual measurement of grip at the rivet location.

- (4) Oversize Repair of Solid Rivets (Mandatory)

When oversize solid rivets are required for standard repair the procedure shall be to use a 1/32 oversize rivet.

NOTE: A maximum of one out of eight holes in a row with no two adjacent.

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Table 15: Rivet Substitution

MECHANICAL	SOLID
NAS1919B04- ⁽¹⁾ or NAS1919B04S ⁽¹⁾	MS20470DD4- ⁽¹⁾
NAS1919B05- ⁽¹⁾ or NAS1919B05S ⁽¹⁾	MS20470DD5- ⁽¹⁾
NAS1919B06- ⁽¹⁾ or NAS1919B06S ⁽¹⁾	MS20470DD6- ⁽¹⁾
NAS1921B04- ⁽¹⁾ or NAS1921B04S ⁽¹⁾	MS20426DD4- ⁽¹⁾
NAS1921B05- ⁽¹⁾ or NAS1921B05S ⁽¹⁾	MS20426DD5- ⁽¹⁾
NAS1921B06- ⁽¹⁾ or NAS1921B06S ⁽¹⁾	MS20426DD6- ⁽¹⁾

⁽¹⁾ Specific grip range - Must be determined to assure proper replacement.

NOTE: 'S' indicates single action rivet.

It is not permissible to substitute a mechanical fastener in place of a solid fastener.

All substitutions are to be from a mechanical fastener to a solid fastener only.

Table 16: Standard Head Rivet

RIVET DIA.	CSK DIA. ± 0.010
0.093 (3/32)	0.122
0.125 (1/8)	0.179
0.156 (5/32)	0.225
0.187 (3/16)	0.286
0.250 (1/4)	0.353

Table 17: Reduced Head Rivet

RIVET DIA.	CSK DIA. ± 0.010
0.093 (3/32)	0.122
0.125 (1/8)	0.163
0.156 (5/32)	0.203
0.187 (3/16)	0.244
0.250 (1/4)	0.325

5. Shims

A. Shims

- (1) Shims / Spacer for Adjusting the Mounting of Clamps and Hydraulic / Pneumatic Components (Optional)

To alleviate misalignment irregularities due to structural tolerance buildup, the following may be employed:

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The use of circular aluminum shims (AN960, AN961 configuration) or GAS12F nylon adhesive backed shim to a maximum of 1/8 inch thickness are acceptable to raise tube clamps or polyamide clamps (AN960 and AN961 are the preferred shims). Cement shims to structure with spray or bottle adhesives per MMM-A-1058TY1 (adhesive, cyanoacrylate) or see Fuel Resistant Sealing Compound - Fillet and Faying (-65°F to +360°F Service), 51-21-00, Repair. See Figure 4.

The use of NAS spacer (standoff) lengths other than specified on the wiring harness drawings is acceptable, provided that the harness clamps are not distorted. Spacer lengths may be changed plus or minus 1/8 inch from those specified in the Maintenance Manual. See Figure 4.

Structure shims to be used as necessary to raise tube support clamps (blocks) to prevent excessive preload in the lines run.

Length may be increased or decreased to provide clearance to structure piping, etc., as well as to eliminate interferences.

Chaffing conditions are not acceptable.

The use of aluminum shims (3/32 inch maximum thickness) under mounted hydraulic and pneumatic components such as valves, filters, etc. and conforming to the hydraulic / pneumatic component mounting surfaces. Cement shims to structure with spray or bottle adhesive per MMM-A-1058TY1 or MIL-A-46050 Type 1, Class 2 (adhesive, cyanoacrylate) or see Fuel Resistant Sealing Compound - Fillet and Faying (-65°F to +360°F Service), 51-21-00, Repair. See Figure 5.

Shim to be used only to raise component to the line within the requirements of tube alignment.

Mechanical linkage is not to be adversely affected.

The above practices are to be highlighted to inspection during normal acceptance of the area and are not to be construed as permission to violate specification requirements. When the above limits have been exceeded contact Gulfstream Technical Operations for approval.

(2) Laminated Shims - Usage and Substituting (Optional)

Usage

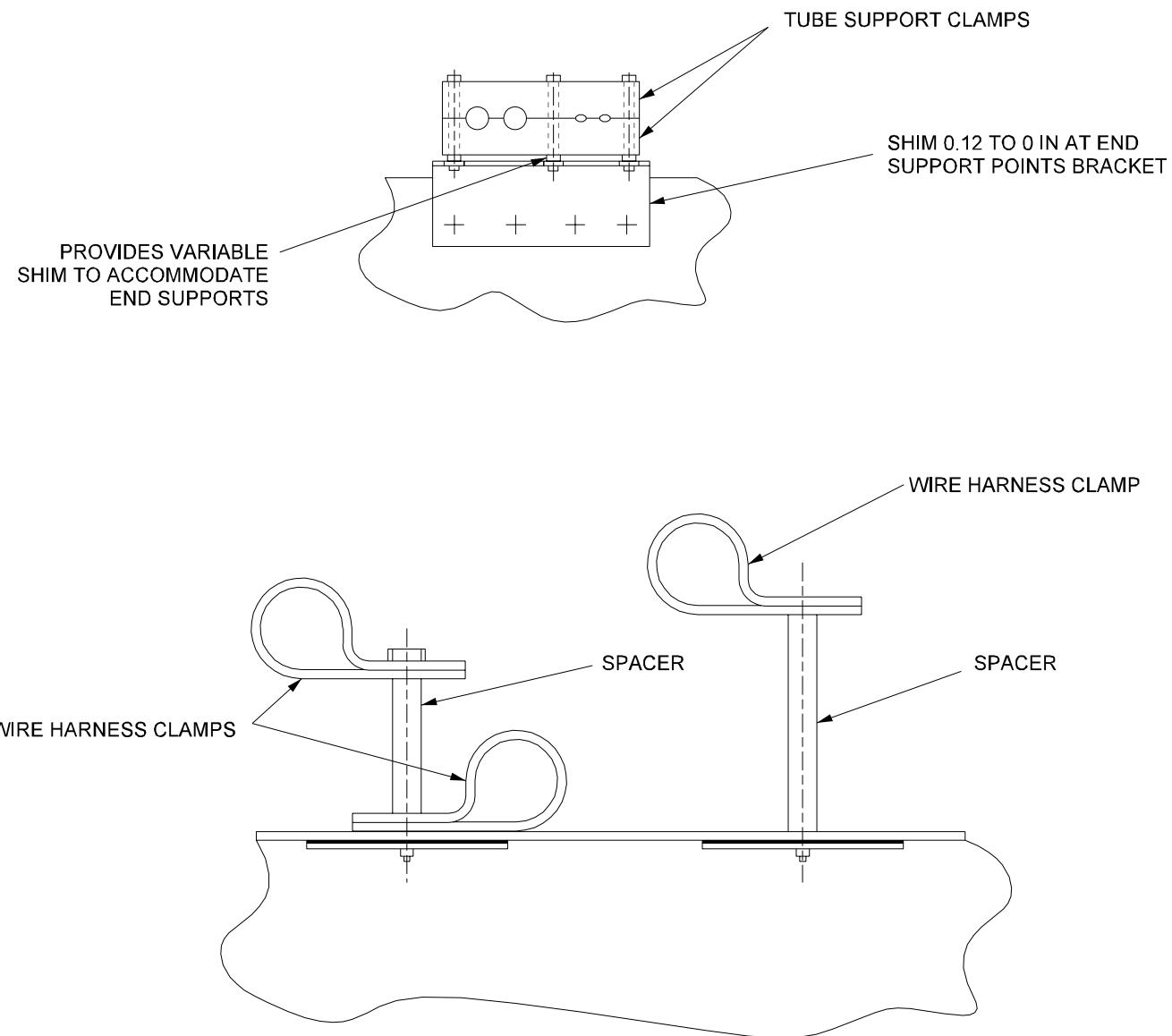
When laminated shims are used the final shim thickness shall be determined by the gap resulting from the manufacturing processes. Thickness of shim can vary from no shim required to full thickness of shim.

Substitution - When aluminum laminated shims are used, solid aluminum shims of the same thickness suitably alodined and primed may be used.

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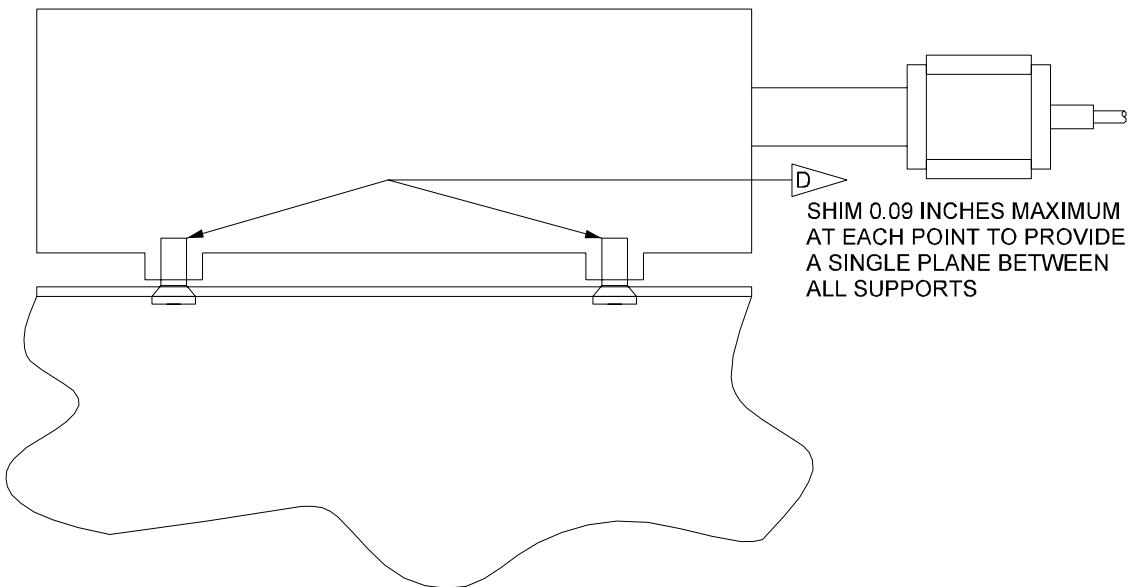
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Shims and Spacers
Figure 4

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Components Shimming
Figure 5

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